

**Effects of Defensive Vehicle Handling Training on
Novice Driver Safety: A Case Study in Lewistown, Montana**

Phase 2: Presentation of Advanced Defensive Driving Training

by

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PROBLEM STATEMENT

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation. Many novice drivers' accidents involve improper reactions to skids, panic stops, run-off-pavement, and other unusual situations unfamiliar to the young driver.

Several organizations in the United States offer training in advanced vehicle handling for novice drivers. Such training typically includes vehicle control on skid pads, obstacle avoidance, rapid deceleration braking, and maneuvering near the vehicle performance limits. While there is considerable anecdotal evidence that such training, added to the standard driver instruction, creates a more capable novice driver, only one systematic study of its effect on the safety of young drivers has been completed. A study of over 400 graduates of an urban, east coast course, reported that the graduates had 77% fewer accidents than their peers. That number, however, was probably inflated by a weak research design in which the more careful and highly motivated teens were self-selected into the training classes.

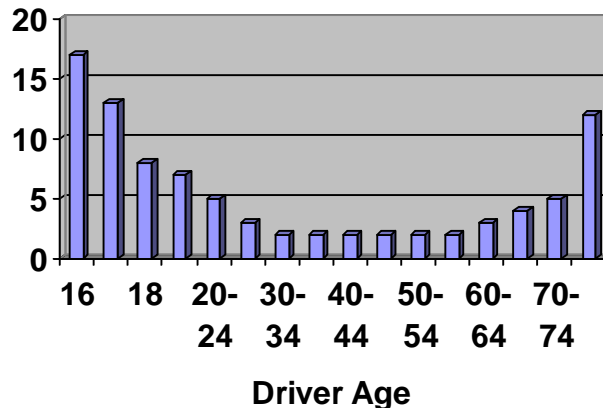
A much more carefully designed and controlled study is needed to validate those results. The needed study would compare demographically equivalent groups of young drivers that were comparable in driving ability and safety motivation.

The Western Transportation Institute has begun a controlled study designed to do this. In the initial phase, accident records for young Montana drivers have been analyzed and a defensive driving curriculum is being designed to address the most common risks. WTI and the Montana Office of Public Instruction have begun recruiting 400 young drivers in central Montana to take part in the study. Training facilities and instructors have been scheduled for the conduct of training workshops during the summer of 2005. This proposal is for the second phase of the project, the actual presentation of training to the young drivers.

BACKGROUND SUMMARY

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation. Many novice drivers' accidents involve improper reactions to skids, panic stops, run-off-pavement, and other unusual situations unfamiliar to the young driver.

Fatal Crashes per 100M Miles



A large percentage of young drivers receive their driving training in school-based classes. These classes typically involve numerous hours of classroom instruction on rules of the road, vehicle operation, and safety. The nascent drivers then spend several hours behind the steering wheel driving in parking lots or in normal traffic on familiar streets. Only rarely do they experience circumstances in which the vehicle must be handled at its performance limits. Most carefully controlled research has found that standard driver education classes have little impact on subsequent driving safety.

There are several training and education models that might be explored for enhancing the skills of young drivers and reducing their accident rates and severities.

Graduated licensing programs have been shown to significantly reduce young driver accidents and fatalities. While these programs don't necessarily improve the skills of young drivers, they do reduce their exposure to peer pressure and hazardous driving conditions during their early driving years.

Driver education in European countries is also much more rigorous than that in the United States. Classroom training is presented on vehicle operating principles and basic maintenance. Typically, behind-the-wheel training provides much more emphasis on the more advanced aspects of vehicle handling in potentially hazardous conditions. Also, the minimum age for driver licensing is usually higher than the ages mandated by the States in the U.S.

Several organizations in the United States offer training in advanced vehicle handling for novice drivers. Such training typically includes vehicle control on skid pads, obstacle avoidance, rapid deceleration braking, and maneuvering near the vehicle performance limits. While there is considerable anecdotal evidence that such training, added to the standard driver instruction, creates a more capable novice driver, only one systematic study of its effect on the safety of young drivers has been completed. A study of over 400 graduates of an urban, east coast course, reported that the graduates had 77% fewer accidents than their peers. That number, however, was probably inflated by a weak research design in which the more careful and highly motivated teens were self-selected into the training classes. A much more carefully designed and controlled study is needed to validate those striking results.

The research proposed in this program will compare two matched groups of novice drivers. Four hundred teens enrolled in driver education will be solicited to participate in a teen driver research project. Two hundred will receive an intervention approximately 6 months after they take driver education that involves a one-day classroom and behind-the-wheel workshop. The workshop will include a pre-assessment of skills based upon Mottola's 10 driving habits, training on the habits and a post-assessment at the end of the day. Most of the day will be involved in training students in the key habits that address the greatest number of driving crashes teens in Montana experience. Communications will be provided to parents and teens at time of recruitment, just prior to workshop, and a tailored communication at the end of the training that outlines the key issues each individual student needs to continue to work on with suggestions to parents on how to help the student. For an additional three months, the student will be encouraged to complete followon exercises for refresher information.

Teens will be tracked for 4 years following the project to determine the driving history comparisons of the control group to those who received the intervention. Reported accidents, violations, and driving experience will be compared.

RESEARCH PLAN

Overview

Approximately 400 high school students between the ages of 14 and 16 who have enrolled in driver education classes in central Montana high schools are being recruited. They will be divided into two groups matched for age, gender, prior driving experience, and other pertinent factors. One group will be assigned to "Standard Training" and the other to "Advanced Training." Both groups will begin with the standard high school driver education class. Six to twelve months after completing their standard classes, the students in the advanced training group will be presented with the advanced defensive handling class.

This training will use the Montana Department of Transportation's defensive driving training facility in Lewistown, Montana. The facility, operated by the Office of Public Instruction, is used to provide advanced handling classroom and in-vehicle instruction to police and emergency response drivers. It is located on abandoned airport runways and taxiways and includes classrooms, skid pads, obstacle avoidance and high speed maneuvering courses. A specially developed curriculum will be prepared and presented by the Montana Office of Public Instruction based on the identified safety challenges faced by Montana's urban and rural teen-aged drivers.

During the ensuing 4-year period, the violation and accident records of the members of the two groups will be tracked and recorded. The differences between the two groups will allow us to estimate the safety benefits, if any, of the advanced handling training for novice drivers.

WTI has divided the effort into three phases: (1) Preparation for the advanced training workshops, (2) Presentation of training and assessments, and (3) Follow-on evaluation of the effects of the advanced training. Separate proposals will be submitted for each phase.

This proposal is for Phase 2. Presentation of the Advanced Defensive Driving Training. It is divided into three tasks as defined in the following paragraphs.

Phase 1: Preparation for Advanced Training Workshops

During Phase 1, WTI worked with OPI to define and refine requirements for the defensive driving course. The course will involve multimedia classroom instruction and several hours of behind-the-wheel experience in situational awareness, decision-making, reaction to hazards, and advanced defensive vehicle handling. An important element will be risk evaluation and avoidance including responses to peer pressures.

The foundation of the curriculum is specifically designed for teen drivers utilizing the Ten Habits of the National Institute of Driver Behavior (NIDB) as a framework for model driving. As a subcontractor to WTI, Professor Fred Mottola, founder of the NIDB and designer and author of the Ten Habits, has designed the curriculum. The curriculum will

specifically address the habits that are linked to the primary causes of teen crashes in Montana. Mottola has completed an analysis of teen accident conditions and causes to serve as the basis of the curriculum. The Curriculum involves a pre-assessment of the teen's skills; a behind-the-wheel instruction period in exercises specifically designed to address the targeted habits including the use of the Skid Monster; and a post-training assessment that will be used to prepare the tailored communication to parents and teens. Additionally, fatigue and distraction indexes with activities to measure susceptibility to each will be developed and incorporated in the day's events.

The young driver course is designed for presentation to groups of 12 or fewer students to allow maximum behind-the-wheel time and interaction with instructors. A one-day (8 – 10 hour) workshop format will be used. A web based resource covering the Ten Habits will also be provided as an informational refresher, and for an additional three months, the teens and their parents will be encouraged to visit the site on a weekly basis.

To obtain the required level of statistical power to accurately differentiate between the two groups of novice drivers, it is estimated that approximately 200 drivers in each of the two training groups will be needed. This estimate is based on a statistical power analysis. For this analysis, WTI assumed that we should be able to identify a real improvement of approximately 10% in the accident rates between the training group and the control group. In order for a statistical analysis to detect this difference at the normally accepted $p=.05$, where p is the probability of deciding that there is an improvement due to the training when the difference is due to random variation in the data, approximately 200 drivers are needed in each group. The power analysis assumed that a statistic appropriate for analyzing frequency data (e.g., Chi-squared analysis) would be used.

Novice drivers are being recruited from the local Lewistown area and from high schools in Great Falls and Billings (approximately 100 miles distant.) School administrators from these areas have been contacted and have provided mailing addresses for their recent driver ed graduates.

Phase 2: Present Advanced Driving Training to Teens.

A workshop/training event will involve an eight to ten hour day that begins at 8:00 a.m. Twelve students a day will be trained utilizing five instructors and six training vehicles. Three sedans will be Skid Monster equipped, one with a video camera to record eye movements and other driver responses. Students living within 45 minutes of the Montana Driver Education Facility will arrive the morning of the workshop/training. Students living further away from the facility will arrive in Lewistown the night before and return home following the training. Travel related expenses will be provided to teens needing to arrive the night before. Transportation may need to be provided.

Prior to the training workshops, all 400 participants will be asked to complete a questionnaire concerning their driving experience, including accidents, near accidents, and violations that have occurred in the period since receiving their driver's licenses.

These will be mailed to WTI and students will receive a \$10 payment for their cooperation.

In preparation for the workshops, the staff of the Montana Advanced Driver Education will need to be trained to provide the assessments and training. This instructor training will involve six days of training on use of the Skid Monster and on providing classroom and in-vehicle instruction tied to the Ten Habits. The project provides for training of twelve instructors that will rotate through the instruction of the 200 teens. The instructors will be selected from the staff of driver instructors that presents adult defensive driving workshops during the summer.

The workshops will present a combination of classroom and in-vehicle training. A ratio of one instructor per two students will be maintained to optimize the training effectiveness. The workshops will be specially tailored from the standard adult workshops to include Mottola's Ten Habits and to make optimum use of the SkidMonster equipment.

The training workshops will be individually presented for each participant. At the beginning of the day, participants will be tested on their driving knowledge and skills. The instructors will, then, provide driving exercises to address any skill deficiencies demonstrated by the individuals. At the conclusion of the workshop, another test will explore the young drivers' new skill level and they will receive a tailored communication suggesting approaches for continued improvement.

Participants will be asked to complete a brief evaluation of the training workshops and suggest ways of enhancing them.

Phase 3: Evaluate Effects of Advanced Training.

The effects of the advanced training will be evaluated using both qualitative and quantitative measures. Both statistical data on the drivers' accident and violation record and interview/survey data will be collected. The data will be collected for a period of four years after the completion of the advanced training courses. At the end of each of the follow-up years, a report will be submitted providing the most current statistics and their interpretation.

Our proposed randomized sampling methodology, with samples this large, should ensure that, on the average, the two groups represent similar socio-economic groups, safety motivation, basic psychomotor skills, and accident exposure. Therefore, differences in accident rates, accident severity, and violation rates should be attributable to the type of driver education provided.

Accident and violation records will be obtained once each year for each of the subjects in each of the two groups. Frequencies of property damage, personal injury, and fatal accidents will be calculated for each of the two groups. Statistical analyses appropriate for frequency data (e.g., Chi-Squared analysis) will be used to explore the significance of differences between groups.

Subjects who have had accidents will be sent a questionnaire requesting additional information. The information will include detailed descriptions of the accident and data about the severity including personal injuries and property damages. Differences between the two groups in the severity of accidents will be statistically analyzed. WTI recognizes that this could be highly sensitive information. We will evaluate the need to obtain a Certificate of Confidentiality from the National Institutes of Health in order to shield the collected information from disclosure in any legal proceeding.

At the end of the advanced training, subjects and their parents will be asked to complete a course evaluation form asking for their comments and suggestions about the course content and presentation style. Their subjective evaluation concerning the value of the course will be sought. At the end of one year after completion of the training, a survey will be mailed to the subjects asking for comments on their driving experiences and how the training might have impacted their level of safety.

If significant differences are found between the groups in accident rate and severity, calculations of the cost/benefits of the training will be calculated using standard economic models.

DELIVERABLES (OR PRODUCTS)

WTI will submit quarterly reports on the status and progress of the research and fund expenditures.

The primary purpose of Phase 2 is the presentation of training. A Phase 2 report will detail the training process, the results, and comments obtained from participants.

SCHEDULE

Task 1: Provide Training to Teen Drivers		M	J	J	A	S	O
Status Review	5/15/2005						
Train the Trainers							
Obtain Training Eqpt. And Materials							
Train Teen Drivers							
Prepare Draft Report	8/31/2005						
Prepare Phase Report	10/31/2005						

STAFFING

Michael Kelly, Ph.D. is proposed as Principal Investigator. He is currently Senior Research Scientist and Research Director at WTI and has over 25 years experience in research related to human factors, transportation systems, safety, and training. He has approximately 70 research publications in these areas. He is Principal Investigator on the Phase 1 effort of this project.

Laura M. Stanley will assist with supervision of participants, training presentation, and direct analysis of safety records. She is currently pursuing a doctorate in industrial engineering at MSU and is experienced in the analysis of accident and safety records at another major university transportation research center.

David Huff of OPI will coordinate the training instructors. He is currently Director of Traffic Education for the Office of Public Instruction and directs training activities at the Montana DRIVE facility.

FACILITIES

The Western Transportation Institute (WTI) at Montana State University would lead the proposed study in close coordination with Montana OPI and MDT. WTI is the nation's premier research center on rural highway transportation issues. Our 70 staff members and students perform a broad range of research related to advanced highway technology, winter maintenance and mobility, infrastructure, safety, animal-vehicle interactions, tourism and other areas. We currently have ongoing research in 35 states.

This training will use the Montana Office of Public Instruction's Driver In-Vehicle Education (DRIVE) facility in Lewistown, Montana. The facility, operated by the Office of Public Instruction, is used to provide advanced handling classroom and in-vehicle instruction to police and emergency response drivers. It is located on abandoned airport runways and taxiways and includes classrooms, skid pads, obstacle avoidance and high speed maneuvering courses. A specially developed curriculum will be prepared and presented by the Montana Office of Public Instruction based on the identified safety challenges faced by Montana's urban and rural teen-aged drivers.

Three Chevrolet Luminas have been borrowed from the Montana State motorpool for the training workshops. These will be equipped with the SkidMonster systems on the rear wheels to simulate driving on wet or icy roads. One of the vehicles will be equipped with an in-vehicle video camera to demonstrate to the students whether they are using an optimum pattern of visual scanning while driving.

PROJECT BUDGET

Two alternative budgets are presented.

Budget A, in the amount of \$160,759 includes purchase of three SkidMonster attachments (and the associated support from Prof. Mottola in training instructors in their use). Under this alternative, the SkidMonster attachments will be available for future MDT and OPI driver training and driver training research. The cost of purchasing the SkidMonsters in this option is \$23,150.

Budget B, in the amount of \$146,899 includes a three-month lease of the three SkidMonster attachments (and the associated support from Prof. Mottola. Under this option, the SkidMonster attachments will be available only during the summer of 2005. The cost of the SkidMonster lease in this option is \$11,600.

Both options also include the following elements:

WTI Labor (burdened) to support the training and supervise participants. \$17,153

WTI travel and per diem to Lewistown. \$1930

OPI Subcontract for expenses of training the trainers and participants. \$79,000

Hartos Subcontract for tailored communication and feedback to participants. \$8500

Transportation, Lodging, Box Lunches for participants. \$19,310

Budget		WTI Team								
		Mike Kelly	Name	Graduate Student (fellowship)	Undergrad (2yrs exp)	Communications Manager	Business Manager	Support Staff	Name	Total Hours/Total Costs
Task #	Task Title	\$63.74	\$0.00	\$0.00	\$9.88	\$33.19	\$33.19	\$20.08	\$0.00	
		120		120	160		80	120		600
		\$7,648.80	\$0.00	\$0.00	\$1,580.80	\$0.00	\$2,655.20	\$2,409.60	\$0.00	\$14,294.40
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
	TOTAL HOURS	120	0	120	160	0	80	120	0	600
	TOTAL DIRECT COSTS (includes ben.)	\$7,648.80	\$0.00	\$0.00	\$1,580.80	\$0.00	\$2,655.20	\$2,409.60	\$0.00	\$14,294.40
	Indirect Costs at 20%	\$1,529.76	\$0.00	\$0.00	\$316.16	\$0.00	\$531.04	\$481.92	\$0.00	\$2,858.88
	Total Project Costs	\$9,178.56	\$0.00	\$0.00	\$1,896.96	\$0.00	\$3,186.24	\$2,891.52	\$0.00	\$17,153.28

	Budget	Other Direct Expenses							Totals
		Travel	Operations/Communications	Minor Equipment (<5000)	Participant Support	OPI subcontract	Harios subcontract	Mottola subcontract	Total Costs
Task #	Task Title								
		\$ 1,930.00			\$ 19,310.00	\$ 79,000.00	\$ 8,500.00	\$ 23,150.00	\$146,184.40
									\$0.00
									\$0.00
									\$0.00
									\$0.00
	TOTAL HOURS								
	TOTAL DIRECT COSTS (includes ben.)	\$ 1,930.00	\$ -	\$ -	\$ 19,310.00	\$ 79,000.00	\$ 8,500.00	\$ 23,150.00	\$146,184.40
	Indirect Costs at 20%	\$386.00	\$0.00	\$0.00	\$0.00	\$5,000.00	\$1,700.00	\$4,630.00	\$14,574.88
	Total Project Costs	\$ 2,316.00	\$ -	\$ -	\$ 19,310.00	\$ 84,000.00	\$ 10,200.00	\$ 27,780.00	\$160,759.28

Table 2. Budget B: Training with Leased Skidmonsters

Budget		WTI Team								
		Mike Kelly	Name	Graduate Student (fellowship)	Undergrad (2yrs exp)	Communications Manager	Business Manager	Support Staff	Name	Total Hours/Total Costs
Task #	Task Title	\$63.74	\$0.00	\$0.00	\$9.88	\$33.19	\$33.19	\$20.08	\$0.00	
		120		120	160		80	120		600
		\$7,648.80	\$0.00	\$0.00	\$1,580.80	\$0.00	\$2,655.20	\$2,409.60	\$0.00	\$14,294.40
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
										0
		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
	TOTAL HOURS	120	0	120	160	0	80	120	0	600
	TOTAL DIRECT COSTS (includes ben.)	\$7,648.80	\$0.00	\$0.00	\$1,580.80	\$0.00	\$2,655.20	\$2,409.60	\$0.00	\$14,294.40
	Indirect Costs at 20%	\$1,529.76	\$0.00	\$0.00	\$316.16	\$0.00	\$531.04	\$481.92	\$0.00	\$2,858.88
	Total Project Costs	\$9,178.56	\$0.00	\$0.00	\$1,896.96	\$0.00	\$3,186.24	\$2,891.52	\$0.00	\$17,153.28

Budget		Other Direct Expenses							Totals
		Travel	Operations/Communications	Minor Equipment (<5000)	Participant Support	OPI subcontract	Hartos subcontract	Motola subcontract	Total Costs
Task #	Task Title								
		\$ 1,930.00			\$ 19,310.00	\$ 79,000.00	\$ 8,500.00	\$ 11,600.00	\$134,634.40
									\$0.00
									\$0.00
									\$0.00
									\$0.00
									\$0.00
									\$0.00
	TOTAL HOURS								
	TOTAL DIRECT COSTS (includes ben.)	\$ 1,930.00	\$ -	\$ -	\$ 19,310.00	\$ 79,000.00	\$ 8,500.00	\$ 11,600.00	\$134,634.40
	Indirect Costs at 20%	\$386.00	\$0.00	\$0.00	\$0.00	\$5,000.00	\$1,700.00	\$2,320.00	\$12,264.88
	Total Project Costs	\$ 2,316.00	\$ -	\$ -	\$ 19,310.00	\$ 84,000.00	\$ 10,200.00	\$ 13,920.00	\$146,899.28